Report on the investigation of

the collision between

2 Sorcerer Powerboats

during a junior racing event at

Portland Harbour

on

19 June 2005

Marine Accident Investigation Branch
Carlton House
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Extract from

The United Kingdom Merchant Shipping

(Accident Reporting and Investigation)

Regulations 2005 – Regulation 5:

"The sole objective of the investigation of an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 2005 shall be the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose of an investigation to determine liability nor, except so far as is necessary to achieve its objective, to apportion blame."

NOTE

This report is not written with litigation in mind and, pursuant to Regulation 13(9) of the Merchant Shipping (Accident Reporting and Investigation) Regulations 2005, shall be inadmissible in any judicial proceedings whose purpose, or one of whose purposes is to attribute or apportion liability or blame.

CONTENTS

GLOSSARY OF ABBREVIATIONS AND ACRONYMS

BSI	-	British Standards Institution
GMSH	-	Gecko marine safety helmet
HIN	-	Hull identification number
HP	-	Horse power
K-class	-	Junior offshore powerboat racing class
K-200	-	A class of racing within K-class for 8 to 16 year olds
K-400	-	A class of racing within K-class for drivers aged 12 and over
K-1000	-	A class of racing within K-class for drivers aged 15 and over
MPH	-	Miles per hour
OOD	-	Officer of the day
ORC	-	Offshore Racing Committee
PAS	-	Publicly Available Specification
PBRC	-	Powerboat Racing Committee
RNLI	-	Royal National Lifeboat Institution
RYA	-	Royal Yachting Association
SAE	-	Society of Automotive Engineers
UIM	-	Union Internationale Motonautique
WORK	-	Wanda Offshore Race Klubb

SYNOPSIS

At 1320, on 19 June 2005, a 13 year old boy suffered serious head injuries when the powerboat in which he was co-driver was struck by another race boat during a K-200 class Junior Offshore National Championship race at Portland Harbour.

The collision occurred as a fleet of 9 boats, each with a maximum speed of about 31mph, was rounding the first 90º left turn marker buoy of an "M" shaped course. The boats were still bunched as the first mark was only 600 metres from the start line. The injured boy's boat, which was being driven by a 10 year old boy who was in his first season of powerboat racing, "hooked" and came to a sudden and unexpected stop directly in the path of a following boat. The other boat, which was being driven by an 11 year old who was also in his first season of racing, had no time in which to take avoiding action. Its bow struck the port side of the stopped boat at or near right angles and, due to its momentum, over rode its side, striking the co-driver who was in the left-hand seat. It then continued to rise vertically into the air, ejecting its two crew into the sea, before coming down stern-first into the water.

The race was stopped very quickly, and first-aid was administered to the injured boy by a paramedic who was a member of the race supervision team. Due to the seriousness of the boy's injuries, he was airlifted by a coastguard helicopter to a local hospital, where he was found to be in a coma. After the collision, the injured boy's safety helmet was retrieved from the sea a short distance away.

K-200 racing involved head-to-head racing by children aged 8 to 16 years of age, divided into two age groups, driving Sorcerer 373 or 375R boats equipped with a 25hp outboard engine. K-class, or junior offshore powerboat racing, had been started by Wanda Offshore Racing Klubb (WORK) 3 years before the accident. WORK is affiliated to the Royal Yachting Association (RYA), which is the governing body for all offshore powerboat racing in the UK, including K-class. The RYA produces an annual racing handbook detailing the rules, regulations and racing calendar for all classes of offshore powerboat racing. The RYA also approves the race officials, requires the individual clubs to send them accident reports, and generally oversees the governance of the sport. This is largely achieved by way of a hierarchical committee/working group system comprising volunteer members who are usually drawn from the powerboating community.

WORK did not carry out detailed risk assessments for the new class, and the interaction of factors like the course design, type of boat to be used, race rules and training requirements were not fully considered. The RYA was not pro-active in monitoring WORK's safety management and development of the class. K-class racing was innovative in that organised junior offshore powerboat racing did not exist previously anywhere in the world.

There were no minimum training requirements to qualify children to participate in K-class racing, although many people believed that 40 hours tuition had been stated and agreed. The children were trained by members of WORK mostly during the winter months and, once judged competent by the instructors and passed fit to race, they were issued with a personal racing licence by the RYA.

The amount of training given to beginners had apparently reduced during the 3 years the class had been in existence. The injured co-driver was an experienced racer. However, the two drivers and the other co-driver, who were directly involved in the accident, were all new entrants for the 2005 season, and had all been signed off as 'ready to race' after receiving fewer than 10 hours tuition. It is believed this inexperience and lack of training had a significant bearing on the circumstances of the accident.

The 3.6 metre Sorcerer boat type was originally designed in the 1960s as a ski boat, with turtle decks and low freeboard to enable skiers to be easily pulled from the water. The boat was widely raced with various sizes of outboard engine and with a great deal of success during the 1970s and 1980s. Production of the boat ceased in 1985. The original Sorcerer 373 and the new 375R were chosen by WORK because they were a good size, provided a stable platform for children to race and there were plenty of cheap secondhand boats available. During the development of the racing class, little attention was paid to the fact that a child would be left unprotected in the event of two boats colliding and one overriding the other.

The value of accident and incident reports was not fully recognised by either WORK or the RYA, and minimal attention was paid to them by both organisations. Some reports, which were required by the RYA for K-class racing, were found to be poorly completed and, in some cases, were received weeks after the RYA's 7 day deadline. The fact that no reports were received from the 2004 racing season went unnoticed at the RYA. The RYA also paid little attention to a letter and enclosed safety assessment which were sent to the organisation in 2004 by the boat's original designer, in which he warned of the dangers associated with the sort of accident that occurred on 19 June 2005.

Better attention to good safety management practices by WORK and the RYA, both during the setting up and development of the class, might well have prevented the accident.

During examination by the MAIB, the dislodged helmet worn by the co-driver was found to have no apparent impact damage. The chin strap was fastened, and the inflatable bladder, which ensured a comfortable fit, was partially inflated, however a sleeve on the chin strap was found to be missing. The MK10 Gecko Marine Safety Helmet was worn by the majority of K-class competitors, and some adults in other powerboat racing classes. It had been designed and manufactured by Gecko Head Gear Ltd, initially for the Royal National Lifeboat Institution (RNLI) to protect its boat crews. It had not been the subject of a detailed assessment to determine its suitability in powerboat racing.

It was also found that, despite a widespread belief that the helmet was “one size fits all”, and therefore appropriate for use by children, the helmet had only been tested in line with the British Standards Institute specification for an adult male head size. The protection afforded by the helmet to persons with head sizes outside this range had therefore not been established.

During the investigation, MAIB issued Safety Bulletin 3/2005, which strongly advised all users of marine safety helmets to ensure helmets are of the correct fit and properly worn at all times. It also recommended that the RYA should conduct a risk assessment to identify a safe helmet to be used by all powerboat racers.

Separate recommendations have now also been made to WORK and the RYA regarding the need for the adoption of good safety management and risk assessment practices in order to help ensure the future safety of the children competing in K-class racing.

Figure 1

Photograph of powerboat K11

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF POWERBOATS AND ACCIDENT (Figure 1)

Vessel details

Boat type	:	Sorcerer 373
Length overall	:	3.65 metres/12 feet
Engine power and/or type	:	Mercury 25hp outboard engine
Maximum speed	:	31mph/27knots
Weight of boat and engine	:	Minimum 235kg, without fuel

Accident details

Description	:	Collision between two powerboats during a junior racing event
Time and date	:	1320 on 19 June 2005
Location of incident	:	Portland Harbour
Persons on board	:	2
Injuries/fatalities	:	A 13 year old child seriously injured
Damage	:	Slight hull coating damage to one boat. Major hull structural damage to the other. **(Figures 2 and 3)**

Figure 2

Hull damage to boat K51

Figure 3

Impact damage to K11

1.2 BACKGROUND - OFFSHORE POWERBOAT RACING

1.2.1 Adult offshore powerboat racing

Adult offshore powerboat racing is an extreme sport, where very high powered boats are raced at speeds of 100mph, or more, in open sea conditions.

The Royal Yachting Association (RYA) is the national governing body for powerboat racing in the UK. The Union Internationale Motonautique (UIM) is the international governing body. There are several classes within the overall framework of offshore powerboat racing, each separately administered by specific clubs or organisations.

All participants in powerboat racing in the UK are required to be registered and licensed by the RYA. There were about 600 RYA registered powerboaters in the UK at the time of the accident.

1.2.2 K-class offshore powerboat racing

K-class offshore powerboat racing was set up in 2002 after the organisers realised that young people were starting adult offshore racing at 16 years of age with little or no experience of handling powerboats in racing conditions. They considered this was undesirable.

K-class is the first and only junior offshore powerboat racing in the UK, and the MAIB could find no evidence of similar racing anywhere else in the world.

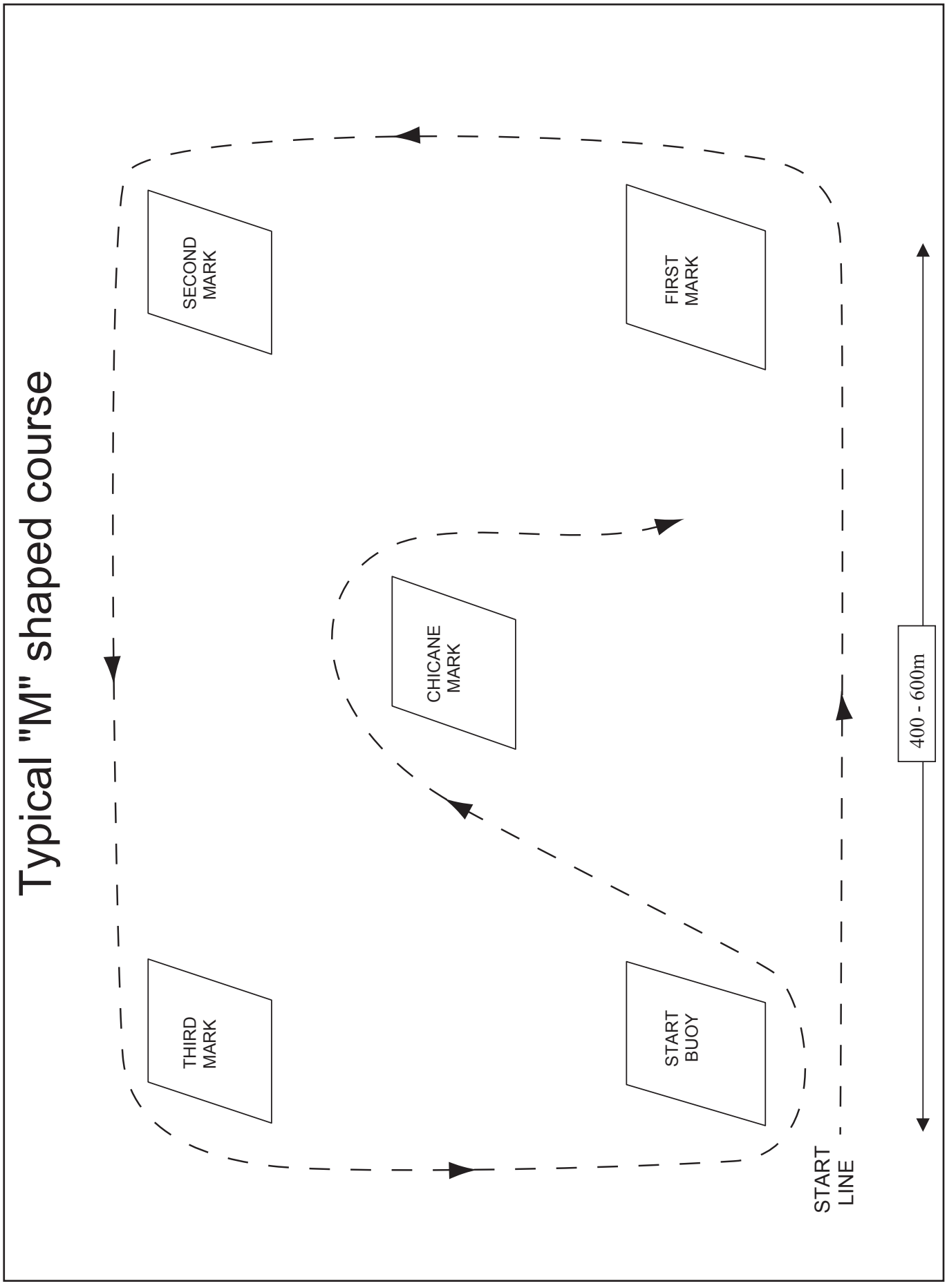
Wanda Offshore Racing Klubb (WORK) was set up to support K-class racing. WORK set up K-class racing to "mirror" adult offshore racing, where possible, to give the young participants as much knowledge and experience in offshore racing as feasible. Part of its objective was to make the transition from junior to senior racing safer for all concerned. It was decided that the participants should race head-to-head around a course similar, but smaller than, the design used in adult racing.**(Figure 4)**

All competitors in K-class racing are required to be members of WORK.

K-class racing was originally set up as one class (K-200) for drivers aged 8 to 16 years of age. However, in its first 3 years, demand continually grew, and the K-1000 sub-class was set up in 2004 for drivers aged 15 years and over. The K-400 sub-class, for drivers aged 12 years and over, was started in 2005.

The K-200 sub-class is further divided for racing purposes into two age groups, as follows:

Class A	Driver 12 to 16	Co-driver 8 to 16
Class B	Driver 8 to 12	Co-driver 8 to 16


Typical "M" shaped course
SECOND MARK
FIRST MARK
CHICANE MARK
THIRD MARK
START BUOY
START LINE
400 - 600m

The children race Sorcerer type powerboats in the K-200 sub-class. The boat crew consists of a driver who sits in the right-hand seat, and the co-driver in the left seat. The co-driver's job is to act as the eyes and ears of the driver and, as such, he or she will keep a careful watch during the competition for race flags and marker buoys. The co-driver also pays close attention to other competing boats as the racing proceeds, especially the boats behind, and will signal to the driver when it is clear to turn at a marker.

Before racing begins, the safety of each boat is checked by a scrutineer. During each race, adult officials are afloat in several boats. The officials include the officer of the day (OOD), a safety officer and a paramedic. Strict racing rules and protocols are applied to each K-200 race. These are very similar to those followed in the adult version of the sport.

1.3 NARRATIVE OF EVENTS

The Sorcerer 373 powerboat was originally designed in the late 1960s for use as a ski boat or beach boat. The design incorporated a low freeboard and turtle decks to facilitate the easy recovery of water skiers from the water.

Manufacture of the original GRP design began in the early 1970s, when boats were fitted with motors up to 40hp SAE. These boats were based on wooden prototypes which were fitted with 18hp SAE engines capable of towing a 90kg skier up to speeds of 25mph.

In 2002, when WORK was setting up K-class racing, it was decided to utilise Sorcerer boats, because they were readily available, could be purchased fairly cheaply and were a good size for children's racing. New boats could be supplied by a local builder, Sorcerer Ltd., who owned the design copyright, and the boats had a track history of safe racing. The new boats were called 375Rs.

The boat was also tested on the water by a member of WORK. It was found to be very stable and, at just 3.65 metres in length, an ideal size for the requirements.

The founder of WORK, who was at the time the Chairman of the RYA's Offshore Technical and UIM Working Group, informed the RYA of the club's intentions, and sought RYA backing for the venture. Taking into consideration the powerboat racing experience of the organisers, the RYA saw the establishment of K-class racing as a good and safe way to get youngsters onto the water, and to train them in the skills necessary for handling race boats. The affiliation between WORK and the RYA in K-class racing began at this time.

During the winter of 2002/3, a group of children of various ages was assembled to train for the planned 2003 K-class racing season. WORK established the minimum racing age of 8 at this time, after assessing how children of various ages coped with learning to drive the boats and understanding the rules. During the winter of 2002/2003, the children were trained, their proficiency tested, and the appropriate compulsory RYA racing licences were issued.

Some secondhand Sorcerer 373 boats were purchased and the local boatbuilder, Sorcerer Ltd, who owned the Sorcerer boat copyright, started building and supplying new racing boats, Sorcerer 375Rs, to the club and some private owners. The original boat design did not now comply with the 1998 Recreational Craft Directive, but it was still possible to build and sell such boats provided they were marked and used for racing only.

The inaugural season was planned as a series of weekend race meetings, in which children aged between 8 and 16 years of age raced against each other, head-to-head, in two age classes. Race meetings were arranged and held at various English venues, and because of the RYA affiliation the races were classified RYA National Championship Races.

On Saturday 7 June 2003, two people were sent to hospital, suspected of suffering whiplash, after the boat they were racing off Bournemouth was hit by another boat during one of the first races (see section 1.9).

Before and during this first season, concerns arose over the vulnerability of the crew in the event of a collision, and anti-intrusion bars were fitted to all Sorcerer K-200 class boats (see paragraph 1.5.1).

By the end of the first season, K200-class racing was considered by WORK and the RYA to be successful, and it was decided to continue racing the following year. In fact, another class of racing was initiated for the 2004 season, called K-1000, for persons aged 15 and above, crewing larger 4.8m (16ft) boats.

More children applied to join the club, and were trained during the winter of 2003/4 to enable them to participate in the 2004 season. By 2004, the number of Sorcerer racing boats owned privately, and by the club, had increased, and now included 7 new hulls from Sorcerer Ltd. However, a dispute between the founder of the club and Sorcerer Ltd resulted in the club ordering no more boats.

Sorcerer Ltd had concerns regarding the number of accidents that had occurred during the first racing season. They had repaired a number of damaged boats during the season, and had anecdotal evidence of the types of accidents that were occurring. The original boat designer also had concerns about K-class racing and, in particular, the accident off Bournemouth that had occurred early in the 2003 racing season. These concerns were made known to the RYA via a series of communications early in 2004.

The 2004 season started with a meeting at Allhallows Club at the end of April. The next meeting was held during May, in the docks at Bristol, a venue which is widely agreed by many powerboaters to be very demanding due to the limited space available for racing, and the close proximity of harbour walls, which tend to cause disturbed water. This was the first powerboat race meeting to be held at Bristol since racing had been stopped 14 years earlier due to safety concerns.

During the weekend racing at Bristol, two boats collided, resulting in damage to the hull of one boat by the propeller of the other boat as it had ridden up alongside her (see section 1.9).

The 2004 racing season was deemed a success by the club and the RYA and, with the number of competitors still growing, another sub-class, called K-400, was added for the 2005 season for children 12 years and older, driving 4.26m (14 ft) boats.

Training of children for all the sub-classes of racing continued during the following winter to prepare them for the 2005 season.

One of these children, Boy A, was a 9 year old who obtained an RYA licence to race dated 16 March 2005.

Two others were friends aged 11 and 13 (Boy B and Boy C), who were issued with licences dated 19 and 20 April 2005.

The first race of the 2005 season was held at Allhallows during the weekend of 23/24 April. All three boys competed, with the two friends alternating as driver and co-driver of their boat. They raced again at the next meeting in Bristol 4 weeks later where, with the younger boy, Boy B, driving, they collided with the dock wall, badly damaging the boat.

Boy A competed at the next race meeting held a few weeks later at Ramsgate on the weekend of 11/12 June, and all of the boys competed in the following meeting at Portland Harbour the next weekend.

During the afternoon of Saturday 18 June, Boys B and C were competing in a race when the driver, Boy B, pulled the boat into the centre of the course because Boy C was complaining of back pain. The child was recovered from the boat using a spinal board and transferred to a local hospital as a precautionary measure. No injury could be found during an examination at the hospital, and the boy returned to the meeting about 2 hours later. An accident reporting form was completed by WORK, and later sent to the RYA. It wrongly stated that Boy C's licence had been withdrawn.

The racing continued the following day, Sunday 19 June. At about 1315, the organisers mustered 9 boats together in a line and the Class B (younger age group) race was started. Boy B was the driver and Boy C the co-driver of boat K51, while Boy A was driving boat K11 with a co-driver who was a very experienced 13 year old boy.

The three lead boats safely passed the 1st turn marker buoy. They were being closely followed by K11 and the other 5 boats. As K11 started the turn, it suddenly stopped in the water broad-side on to the following boats. Boat K51 had been close behind and it collided with K11's port side. K51 rode up over K11's side, and K51's bow struck the 13 year old co-driver. The boat continued

climbing vertically into the air, and its two crew (Boy B and Boy C) were ejected into the sea as it turned, before it came down stern-first into the sea. K51 settled partly submerged, with just the bow showing above the water.

The race was immediately stopped (red flagged) and waterborne officials attended the scene. A paramedic in a safety boat was alerted by a course safety official to K11 after the driver (Boy A) had been seen signalling for attention. On arrival alongside, the paramedic found the co-driver lying in the boat, unconscious, with a strong pulse, but he was not breathing. The paramedic immediately started mouth to mouth ventilation, and the casualty was transferred by safety boat to the shore pontoon a short distance away.

Boy B and Boy C were retrieved uninjured from the water along with the casualty's helmet which had become dislodged during the accident.

The casualty was breathing unaided on arrival at the pontoon, and the emergency services were called by a team of St John ambulance personnel.

An ambulance arrived promptly on scene and the decision was made, due to the severity of the injuries, to transfer the casualty to hospital via the Portland coastguard rescue helicopter, based a short distance away.

The casualty was airlifted to Dorset County Hospital where the injured boy was found to be in a coma. He was later transferred to Southampton General Hospital. He recovered consciousness some days later and has continued to make a slow recovery over the succeeding weeks.

1.4 ENVIRONMENTAL CONDITIONS

On the day of the accident the environmental conditions were:

Wind	S to SE 4/5
Sea	3/4
Visibility	Very good

An RYA Commissioner's report stated:

"Choppy sea, borderline conditions at times for junior classes aged 8-12 Yrs in the K200 Sorcerer boats".

1.5 K-200 BOAT AND ENGINE TYPE

1.5.1 The boat

The K-200 race boat is based on a standard glass reinforced plastic (GRP) Sorcerer hull. There is a fore deck and windshield, behind which are two floor-mounted seats, one on runners enabling it to be adjusted fore and aft to suit the leg length of the driver. In addition, each boat is fitted with an anti-intrusion bar.

The anti-intrusion bar was added during the 2003 racing season to protect the crew from injury caused by boats overriding or riding up alongside each other during racing **(Figure 5)**.

The boats do not possess or require an official hull identification number [HIN]. However, they do have a specific number to identify individual boats, which is detailed on the boat's "K Class One Design Compliance form" held by the RYA.

1.5.2 Engine

The K-200 boat is powered by an outboard engine controlled by a throttle pedal **(Figure 6)** and gear lever **(Figure 7)**, and steered remotely by a wheel sited at the right-hand of two seats.

Just before the beginning of the 2005 racing season, it was agreed to increase the power of the engines from 20 to 25hp (see paragraph1.8).

RYA rules require all engines to be fitted with engine kill switches. Both crew are attached by cords to a device which stops the engine if either cord becomes disconnected. Kill switches provide important protection in case a crew member is ejected from a boat into the water and is in danger of coming into contact with his or her boat's rotating propeller.

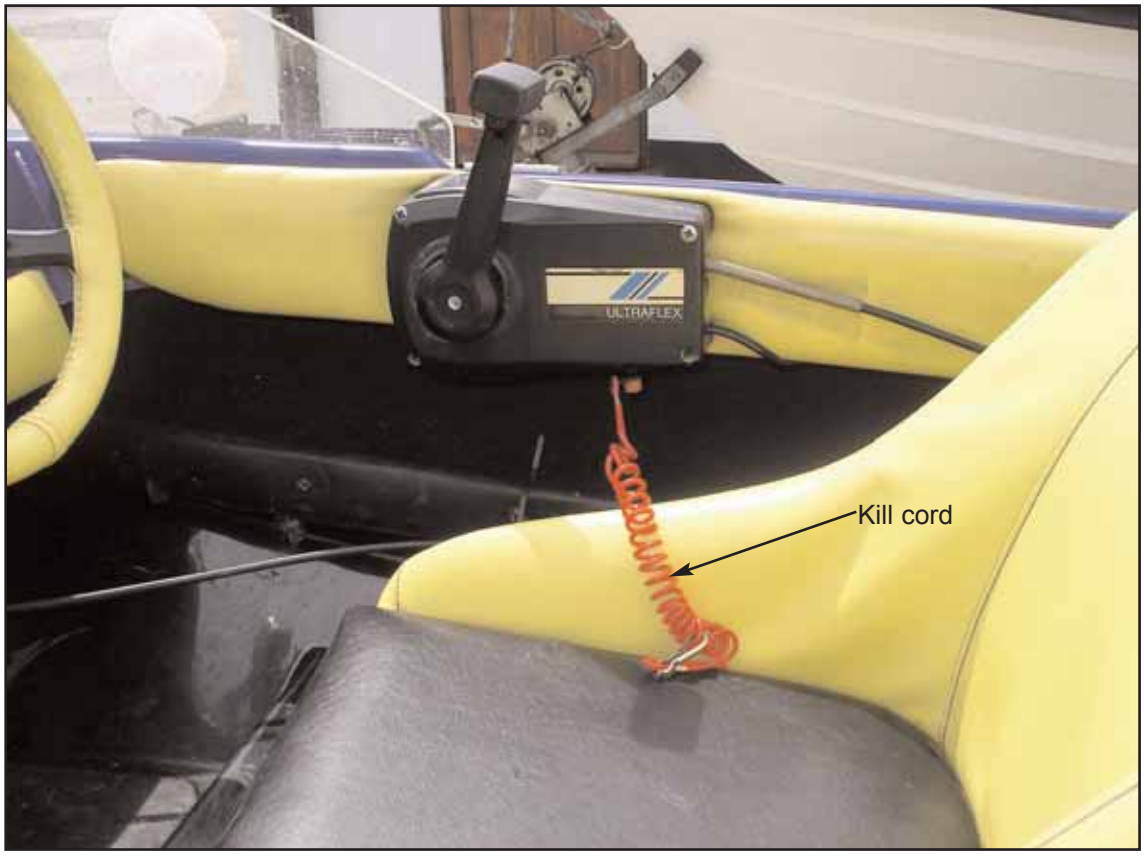
Figure 5

Anti-intrusion bar

Figure 6

Typical foot pedal arrangement

Figure 7



Typical gear lever arrangement

1.6 SAFETY HEAD PROTECTION

1.6.1 Head protection - general

The injured co-driver of boat K11 was wearing a MK10 Gecko Marine Safety Helmet (GMSH), which became dislodged at some time during the accident and was found floating in the sea with the chin strap fastened and the internal bladder partially inflated. A neoprene sleeve used to assist in securing the chinstrap was missing. The visor was found to be cracked, but apart from this, there were no visible signs of impact or damage on the helmet.

The driver and co-driver of boat K51 were wearing children's motorcycle helmets, and neither received any injuries during the accident.

The majority of children involved in K-class racing used the MK10 GMSH for some, or all, of the following reasons:

- It was believed to be appropriate for powerboat racing (as it was used in many other classes including Zapcat racing),
- It was lightweight,
- It was recommended by WORK,
- It was the only specialist marine safety helmet on the market,
- It was thought to be a "one size fits all" helmet. Parents were under the impression they could buy one and that it would continue to fit the children as they grew,
- New participants saw other children using them, so felt no reason to question the suitability of the GMSH,
- The helmet "looked good".

Additionally, a number of parents were aware of arguments against using motorcycle helmets for this type of sport, including the fact that they were heavy for children to wear and could cause neck injuries due to a *scoop* or *bucket effect* if crews were ejected from boats at high speed.

However, some parents and children chose to purchase motorcycle helmets to give more impact protection because they were CE approved, or because they were less expensive than the MK10 GMSH.

1.6.2 The MK10 Gecko Marine Safety Helmet (GMSH) **(Figure 8)**

Gecko Headgear Limited developed the MK5 marine safety helmet for the RNLI and other users, and it was tested by BSI to conform to the European personal protective equipment directive. During the late 1990s, the helmet was used extensively by the RNLI and other organisations, and Gecko continued to develop the design based on feedback received.

In the absence of a minimum standard for marine safety helmets either in the UK or Europe, in 2002 Gecko requested BSI to develop a national standard.

As a consequence, BSI produced a Publicly Available Specification (PAS) detailing "the performance requirements and test methods for a marine safety helmet intended to be worn for users of small, fast craft", namely PAS 028:2002.

By that time, Gecko had developed a MK10 Marine Safety Helmet, and BSI was asked to test and confirm it conformed to the new standard. It was tested for a head circumference range of 57 to 62cm, which is the average head circumference of an adult male.

The helmet was of a new design that, in order to cope with a wide range of head sizes, incorporated an internal inflatable bladder which, after donning, was inflated via a mouth piece to produce a comfortable fit.

BSI successfully tested the helmet and issued the manufacturer with a test report. MK10 Marine Safety Helmets that were manufactured following the BSI test bore the BSI mark and were stamped to indicate head sizes of 57-62cm **(Figure 9)**.

1.6.3 Recommended helmet standard

For a number of years, the RYA has recommended in its Powerboat Racing Handbook (PB1) that all participants in powerboat racing should use **crash helmets** "*to BS 6658B (with temple protection) …*;" adding that "*the efficiency of a helmet is the responsibility of the wearer*".

BS 6658B is a minimum UK standard for motorcycle helmets and, as such, provides the wearer with the minimum degree of impact protection believed necessary for a motorcyclist involved in a road traffic accident. To achieve this protection, the helmet is of solid construction with ample padding for protection.

It was found during the investigation that most parents and children in WORK were unaware that the RYA recommended this standard.

The specific rules for K-class racing, also included in the PB1, state all competitors "*must wear **crash helmets** of a suitable type …*", and "*it is mandatory for all competitors to wear all safety clothing and equipment required by the rules; however, the efficiency of the crash helmet and racing vest is the sole responsibility of the parent and child*".

The organisers of WORK visited a national boat show, in search of appropriate safety equipment for children, and were informed by Gecko Headgear Limited at its stand that its MK10 **safety helmet** was suitable for everyone, as long as the helmet fitted. Bearing that conversation in mind, WORK recommended Gecko as its preferred supplier of helmets to all parents and children in K-class racing.

Figure 8

Actual MK10 GMSH worn by the injured co-driver

Figure 9

Helmet embossed size marking

1.7 TRAINING AND EXPERIENCE OF THE BOAT CREWS

K-class powerboat training was provided by members of WORK. In addition, during the first winter, RYA officials were asked, and agreed to become involved in the training programme for children. WORK wanted the RYA involvement to ensure the training was to an agreed suitable standard, and to give the organisation first-hand knowledge of the new class. There was no standard syllabus, and no minimum amount of training laid down by the RYA or WORK.

At that time, most of the children attended numerous training weekends before WORK instructors deemed them competent to race. During the first few races, adults also acted as the co-drivers, to check on the drivers' competence and safety.

After the first few races, the RYA withdrew from direct involvement in the training and supervision of K-class racing, as they believed the class was being run competently.

In between the first and second seasons, during the winter of 2003/2004, each new entrant had to attend a number of training weekends run by WORK before they were found competent and were issued with an RYA licence to race.

Before the 2005 racing season, it appears that the amount of training required was reduced.

Boy A attended a "taster" training weekend in early 2005, which had been given to him as a Christmas present. The boy, although then only 9 years of age, was already an experienced boat handler and had operated his own boat since he was 6 years old. During the taster weekend, he spent part of the first morning in a boat with an instructor, and the rest in a classroom learning racing rules and flag identity. The second morning, he received more classroom training and spent more time in a boat with an instructor, driving around a course. He decided to continue the training, and he attended another weekend of training on 19/20 February, when he received further classroom and waterborne instruction and, after evaluation and a written test, was "signed off" by the organisers of WORK as "ready to race". He immediately applied for, and received, an RYA racing licence dated 16 March 2005, and raced for the first time at Allhallows on 23 April.

Boys B and C joined WORK just before the start of the 2005 racing season. The younger boy (Boy B) had some experience of boating, however Boy C had none. They attended a training weekend on 16/17 April, where they received some tuition on the Saturday morning concerning racing rules and flag recognition, and some waterborne training in the afternoon. On the Sunday, they received further shore-based and waterborne training, and were found competent to race after evaluation and passing a written test.

The two boys applied for racing licences from the RYA on the appropriate form dated Saturday 16 April, their first day of training, and received their licences a few days later. They competed in their first national championship race the following weekend, just 7 days after they had entered the sport.

1.8 RYA GOVERNANCE OF POWERBOAT RACING

The RYA was involved in the development of K-class racing from its inception as it recognised the importance of training children from a young age in the procedures and skills required for powerboat racing. RYA officials were actively involved in training the children prior to the first racing season, and they attended the first few races of the inaugural season.

The RYA is the governing body for all powerboat racing in the UK and, as such, publishes general rules for the sport and specific rules for each class, including K-class racing, in its annual publication, PB1. The handbook contains the details of all UK national race classes, the year's racing calendar, licensing procedures, general rules for the boats and equipment, general rules and regulations for powerboat racing, specific rules for the individual race classes including K-class racing, and a list of RYA-approved race officials.

One anomaly in PB1/04 (2004), concerning K-200 racing, is the clear indication that co-drivers should be from the same age group as the drivers in the two sub-classes, that is:

	Driver	Co-driver
Class A	12-16	12-16
Class B	8-12	8-12

as detailed in Section 1.2. This was not in accordance with the procedures adopted by WORK.

The RYA specifically employs two people to oversee and facilitate the governance of all powerboat racing. However, the governance is mainly achieved by committees and working groups manned by volunteers who are, or who have been, actively engaged in the sport **(Figure 10)**.

Due to administrative reasons, the RYA has not produced the 2005 rule book publication PB1/05, and the various racing clubs have been told by the RYA to continue racing using the 2004 rules.

The clubs are required to submit requests for changes to the rules prior to the start of a racing season, and in the normal course of events, once the RYA agrees to the changes, the next year's rule book is amended. The racing clubs submitted their requests for 2005 rule changes to the RYA in time for inclusion in PB1/05, however, as no rule book has been published, the RYA allowed the agreed amendments to be implemented by the clubs themselves, in the form of an amendment to the existing 2004 rule book.

RYA committee structure for offshore powerboat racing

WORK requested a number of changes to the 2004 K-200 class rules, including an upgrade of the boat's engines from 20hp to 25hp. This came about partly because the 20hp engine was difficult to obtain, but also because some parents believed others were gaining an unfair advantage by secretly fitting 25hp carburettors to the 20hp engines. The RYA agreed to the changes because the production of 20hp engines had been stopped in the UK and the larger engines were only expected to result in an increase in the boat's top speed of 1-2mph.

Other services the RYA provides for the clubs include:

- Issuing personal licences for racing,
- Overseeing boat class compliance,
- Providing insurance services.

A number of officials are required to organise and run an offshore race meeting, these include:

- OOD whose duty is to oversee the management of a race meeting, and who is the person “in charge” of an event.
- The safety officer, who is the deputy to the OOD and co-ordinates the safety service on shore as well as on water.
- The scrutineer, who before racing, determines whether the boats conform to the class rules, the participants have the appropriate licences, and confirms the boat and crew have the appropriate race and safety equipment by completing and signing a scrutineer checklist form for each boat.
- RYA commissioners, who attend and observe race meetings, especially where changes have taken place, or where particular concerns have been raised. They provide short reports to the RYA.

These, and other officials, are required to be RYA approved for their appropriate discipline, and their names and contact details are published in PB1.

1.9 K-CLASS ACCIDENT AND INCIDENT REPORTING TO THE RYA

All racing clubs are required to report incidents and accidents to the RYA within 7 days, using form PB16 and PB16H, primarily for insurance purposes. The RYA’s powerboat racing manager also sees the reports, and some are brought to the attention of the RYA's Safety and Technical Group and/or its Offshore Racing Committee **(see Figures 11 and 11a)**.

The forms contain a detailed list of what to report, and more information on this is contained in the powerboat racing handbook PB1.

ROYAL YACHTING ASSOCIATION
RYA HOUSE, ENSIGN WAY, HAMBLE,
SOUTHAMPTON, SO31 4YA
Tel: 02380 604238/239 or 07799 640988

INCIDENT NO:

Copies sent to: Broker, IWP, JSRC/CRC/ORC Chairmen
Others: _____
_____
Date sent:

RYA OFFSHORE POWERBOAT RACING INCIDENT REPORT FORM - PB16

1. **An Incident Report Form MUST be completed, copied to appointed RYA and UIM Commissioners and then sent to the RYA within 7 days when:**
   - **A) any personal injury has been sustained, on or off the water, to the extent that professional medical treatment or evaluation is required,**
   - **B) any race, rescue, spectator or other boat has been damaged in an accident/incident, to the extent that replacement parts and/or work is required to accomplish the repairs,**
   - **C) an accident/incident causes a race boat to sink or overturn,**
   - **D) an accident/incident results in accidental contact between a racing boat and any person, property, aircraft or non-racing water craft,**
   - **E) a race has been stopped as a result of accident/incidents,**
   - **F) a driver, rescue or other person has been in the water as a consequence of or the cause of an incident,**
   - **G) or for any other reason which concerns the OOD/Commissioner/Observer.**
2. **If possible, the Medical Officer to complete any injury description.**
3. **When an injury has been sustained which has resulted in the withdrawal of a licence, the Club must complete a PB17 and send it with the withdrawn licence to the RYA as soon as possible.**
4. **The OOD must sign the form after it has been completed.**

EVENT DETAILS:

Title of Event: _____ Date: _____
Organising Club: _____ Venue: _____
Race Status: _____ Classes: _____
Officer of the Day: _____ Safety Officer: _____

INCIDENT INVOLVED:

Boat Name: _____ Class: _____ **Race No**: _____
Hull Type: Mono ☐ Tunnel ☐ RIB ☐ Measurement No: _____
Driver: _____ Licence No: _____ Type: _____
Co-Driver: _____ Licence No: _____ Type: _____
Crew: _____ Licence No: _____ Type: _____
Crew: _____ Licence No: _____ Type: _____

TYPE OF INCIDENT:

Boat Damage: ☐ Personal Injury: ☐ Fatality: ☐

Were any Spectators/Third Parties involved: NO: ☐ YES: ☐

Time of Incident: _____ Race/Practice/Other: _____
Location: _____

DESCRIPTION OF INCIDENT:

Describe any damage to Boat rendering it unfit to race:

Sea state: _____ Visibility: _____ Wind force: _____

DESCRIPTION OF RESCUE:

Event Rescue Boats used: NO: ☐ YES: ☐ (Give details names/skippers):

External Rescue Services used: NO: ☐ YES: ☐ (Give details):

Describe Rescue Operation (including accurate timings):

Length of time between Incident and Rescue: _____

Was the race stopped?: _____ Or curtailed? _____ Protest made? _____

DIAGRAM OF INCIDENT: (if helpful)

DETAILS OF INJURED: (to be completed by Medical Officer where possible)

Name:_____ Licence withdrawn: NO: ☐ YES: ☐ (see PB17)
Attended by: Doctor: ☐ Paramedic: ☐ Other: Name: _____
Ambulance: NO: ☐ YES: ☐ Taken to Hospital: NO: ☐ YES: ☐
Name of Hospital: _____ Retained in Hospital: NO: ☐ YES:
Brief details of injuries:

_____
_____
_____

Name:_____ Licence withdrawn: NO: ☐ YES: ☐ (see PB17)
Attended by: Doctor: ☐ Paramedic: ☐ Other: Name: _____
Ambulance: NO: ☐ YES: ☐ Taken to Hospital: NO: ☐ YES: ☐
Name of Hospital: _____ Retained in Hospital: NO: ☐ YES:
Brief details of injuries:

_____
_____
_____

Name of Medical Officer: PRINT:_____ Sign: _____

LIABILITIES:

IS THIS INCIDENT LIKELY TO RESULT IN A CLAIM ON THE R.Y.A. POWERBOAT RACING LIABILITY INSURANCE?

NO: ☐ NOT SURE: ☐ YES: ☐ (give name and address of likely claimant/s):

_____
_____
_____

Reason for claim (property/boat damage, personal injury, etc.)

_____
_____
_____

REPORT COMPLETED ON (Date): _____

COMPILED BY: (PRINT): _____ Sign: _____

SAFETY OFFICER: (PRINT): _____ Sign: _____

OFFICER of the DAY: (PRINT): _____ Sign: _____

FOR INSURANCE BROKER USE ONLY:

Claim No: _____ Sent to Insurer: YES ☐ NO ☐

Date checked: _____

Signature: _____

(RYAOFFSHOREINCIDENTREPORTFORMPB16) March 2005

ROYAL YACHTING ASSOCIATION
ENSIGN WAY, HAMBLE,
SOUTHAMPTON, HANTS, SO31 4YA
Tel: 02380 604/238/239 Fax: 02380 604291

REFERS TO INCIDENT NO:

FOR RYA OFFICE USE ONLY:
COPIES SENT TO:
BROKER/F&IWP/CHAIRMEN JSRC,CRC,ORC,PRC
OTHERS:……………………………………………
………………………………………………………
DATE SENT:………………………………………..

RYA POWERBOAT RACING HOSPITAL FORM

For all persons taken from an event to hospital (driver, crew, official, guest, spectator, third parties, etc)

To be completed by the Medical Officer or other appointed officer as soon as the extent of the injuries are known and sent to the RYA no later than 48 hours after the injured person has been taken to hospital.

If no Medical Officer or where there are difficulties in obtaining information, enter what is known but send off the form within 48 hours.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

DETAILS OF INJURED

Name…………………………………………………………Function at event …………..……………………………

Name of hospital...…………

Ward name or number………………………………………….…telephone number………………………………...

Brief description of injuries……………………………………………………………………………………………..
………

Length of time likely to be in hospital………………………………………………….

Transfer to another hospital YES/NO/POSSIBLE

If YES name of new hospital………………………………………………………….

Anticipated date of transfer…………………………………………………..

____

Date ....

Medical Officer (PRINT)....................................... (SIGN)..……….................………….......Date……………

Appointed Officer (PRINT)…………………………….. (SIGN) …………………………………...Date……………

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

FOR INSURANCE BROKER USE ONLY

Claim No .... Sent to Insurer YES/NO. Date checked ....

Signature..

RYAPB16H RH Solomon 29.8.00.

Details of the accidents and incidents reported to the RYA since the start of K-class racing

2003

1. Poole 7/8 June

   Type of incident: Personal injury to K-200 driver requiring a hospital check up as a precautionary measure. PB16 sent to RYA shortly after the incident.

2. Poole 7/8 June

   Type of incident: Personal injury to K-200 driver and co-driver, requiring hospital checkup of both children as a precautionary measure.

   PB16 sent to RYA shortly after the incident.

   Description of incident: one boat stopped, and wash caused second boat to glance off port quarter; both crew suffered small amount of whiplash (see sections 2.4 and 2.5.4).

2004

No reported accidents or incidents.

2005

3. Allhallows 23 April

   Type of incident: K-200 boat damage, where engine detached from boat after collision.

   PB16 sent to RYA more than 2 months after the incident.

4. Bristol 22 May

   Type of incident: K-200 boat damage, after collision with dock wall.

   PB16 sent to RYA 1 month after the incident.

5. Ramsgate 12 June

   Type of incident: Personal injury found to K-400 co-driver, after return to pits, and taken to hospital for treatment.

   PB16 sent to RYA shortly after the incident.

6. Ramsgate 12 June

   Type of incident: Personal injury found to K-400 driver on completion of race, and taken to hospital for treatment.

   PB16 sent to RYA shortly after the incident.

7. Portland 18 June

Type of incident: K-200 boat damage.

PB16 sent to RYA shortly after the incident.

8. Portland 18 June

Type of incident: Personal injury to K-200 co-driver, taken to local hospital as precautionary measure.

PB16 sent to RYA shortly after the incident.

9. Portland 19 June

Type of incident: Personal injury to driver of K-200 boat during launching, and taken to local hospital as precautionary measure.

PB16 sent to RYA shortly after the incident.

10. Portland 19 June

Type of incident: K-200 boat damage following collision with another boat.

PB16 sent to RYA shortly after the incident.

11. Portland 19 June

Type of incident: Personal injury to co-driver after boat collision, taken to local hospital.

PB16 and 16H sent to RYA shortly after the incident.

From the above table, it can be seen that WORK reported two accidents during the 2003 season, none during 2004, and none in 2005 until about the time of the Portland meeting.

Report 9 above, shows that Boy C, co-driver of K51 on the day of the accident, had been taken to hospital the previous day as a precautionary measure. The accident report stated that the boy's racing licence had been withdrawn, however this was not the case and is evidence of poor incident reporting.

SECTION 2 - ANALYSIS

2.1 AIM

The purpose of the analysis is to determine the contributory causes and circumstances of the accident as a basis for making recommendations to prevent similar accidents occurring in the future.

2.2 THE ACCIDENT

A spectator took a video recording of the race. This was enhanced and analysed as part of this investigation.

The collision took place at the first turn, when boat K11 violently hooked[1], and K51, which was following immediately behind and on a slightly tighter course to the marker buoy, collided with her at full speed and at a near perpendicular angle. A number of boats had been bunched together as they approached the first turn and, when K11 hooked, it virtually stopped directly in the path of K51, giving its driver no time to take avoiding action.

The precise reason that K11 hooked cannot be ascertained with any certainty. However, the three leading boats had already passed the marker buoy, and their wake, combined with the choppy seas, would have left an area of broken water at the time and location of the collision.

All class rules require the “overtaking boat” to be a minimum of two boat lengths ahead before changing course across and ahead of another boat. The children had been taught that the measurement was to be made between the bow of the leading boat and the bow of the trailing one, and this was the generally accepted interpretation.

Analysis of the video recording taken during the race showed the clear distance between the two boats to be 5.57m as they approached the first marker. In other words, more than two boat lengths bow to bow.

See Figures 12 and 13

The bow of boat K51 collided amidships with K11 at, or near, full speed. Her bow rode up over the gunwale, possibly striking the head of the co-driver of K11, before continuing to climb almost vertically into the air.

See Figure 14

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[1] *In powerboat racing context the term “hooking” refers to a boat inadvertently turning and stopping in a very short distance. Boats are more prone to hooking at a turn marker when the boat’s heading is already altering.*

Hooking can be caused by broken water and the bow suddenly dropping into a trough, or by over steering where the driver tries to make too tight a turn often due to inexperience, or when the kill cord is inadvertently disconnected or the engine stops for another reason, leading to the bow suddenly dropping into the sea.

K11 appears to have still been moving slowly ahead as K51 continued to climb and turn, until the open hull of K51 was pointing in the direction of forward momentum, and her crew were ejected from the boat. K51 then fell stern-first back into the sea.

See Figures 15, 16, 17, 18, and 19

During the course of the collision, the helmet of K11's co-driver became dislodged, and it was later found in the sea a short distance away from the boat.

Figure 12

Position of K11 and K51 just before K11 hooked

Figure 13

Position of both boats as K11 hooked

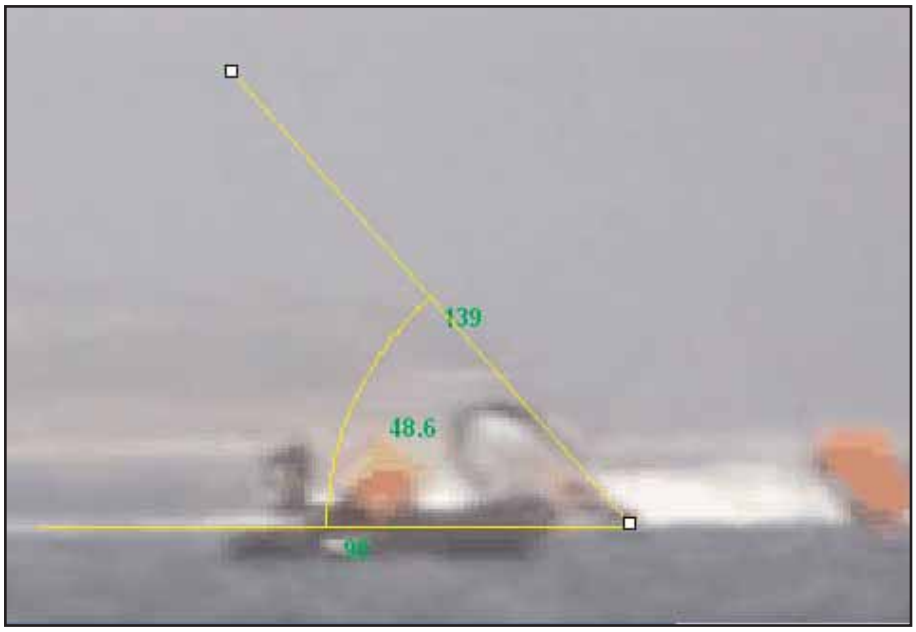


Figure 14
Maximum vertical angle of K51 after impact

Figure 15
Initial collision and hull impact

Figure 16
K51 begins to over run

Figure 17
K51 continues to over run K11

Figure 18
K51 continues to over run K11

Figure 19
One of K51 crew enter the sea

2.3 TRAINING AND EXPERIENCE OF THE CREWS

Neither WORK nor the RYA had formally laid down minimum training criteria for new entrants who might wish to become junior powerboat racers.

Some of the children taking part in the sport had previous experience in handling boats or dinghies prior to starting powerboat racing. However, others had none at all. The RYA consciously left the decision to the trainers at WORK to decide when a child was deemed competent to race. An application signed by the trainer would then be submitted to the RYA for the licence to be issued.

There was a widely held view that a minimum of 40 hours tuition was required, regardless of previous experience, before a licence could be applied for. However, this was not laid down anywhere, and three of the children directly involved in the accident had significantly fewer than 40 hours tuition; in fact two of them had received fewer than 10 hours, including classroom time.

The minutes of the post-accident meeting of the RYA's Safety and Technical Group show that the issue of training was discussed, and it was "felt that the training programme of 40 hours, mainly based on water, but with classroom elements, was very thorough and justified". It appears from this that the RYA was unaware that some children were receiving significantly fewer than this.

It is probably no coincidence that the collision involved two young drivers who were in their first season, and who had received minimal training in K-class racing. It is of concern that a child with little or no previous boating experience, who had attended just two "training days" in one weekend, was deemed to be competent to take part in a national championship race, in head-to-head competition with other boats, the following Saturday, at the start of the season.

2.4 ACCIDENT AND INCIDENT REPORTING

2.4.1 Accident and incident reporting requirements

The RYA requires clubs to report accidents and incidents, such as:

- When a boat is damaged so as to be unfit to race,
- If a driver is injured,
- In the event of any "racing accident".

The MAIB found evidence that clubs have differing views about "which" accidents to report and "what" information to include in a report. It gained further evidence to support the belief that the clubs felt that the reports were not properly acted upon by the RYA. Indeed, the MAIB found that the RYA has in the past viewed such reports mainly as an insurance concern, rather than a method of learning important safety lessons from the individual classes.

WORK included in an accident report the fact that the licence had been withdrawn from the co-driver of K51 following an incident on the day before the accident, yet he was allowed to race the following day. In adult racing, a medical examination and a doctor's permission are required before a licence can be reinstated. It was not clear from either the RYA's or WORK's instructions what circumstances might require a child's racing licence to be withdrawn, or what remedial action was required before a licence could be reissued.

Scrutiny of the club's records suggests that WORK was not giving sufficient priority to the completion and submission of accident and incident reports. It is of note that no reports were made in 2004, despite there being at least one reportable accident, and none in 2005 until about the time of this accident. Similarly, the RYA did not monitor this process sufficiently to query the absence of any accident or incident report form from K-class races during 2004, the obvious anomalies in some of the reports and the fact that reports that were received often arrived long after the respective incidents had occurred. Further evidence of poor accident reporting concerns the second accident in June 2003, which is believed to be almost identical to the one under investigation, and not a "glancing blow".

Incident and accident reporting is a valuable safety management tool. The RYA and WORK could have learned valuable lessons prior to the accident if the importance of proper and efficient accident and incident reporting had been practised. WORK and the RYA should have considered each accident and incident carefully, to see if any lessons could have been learned and what action should have been taken to avoid a recurrence. As it was, the accident reports, such as they were, that were received by the RYA, seemed to receive only minimal attention.

2.5 SAFETY MANAGEMENT AND RISK ASSESSMENT

2.5.1 Race organisation

Races were very well organised, and several volunteer adult race officials were involved, many of whom were stationed around the course in boats during the racing. In general, and in pre-race briefings, the safety of the crews was considered paramount. Strict racing protocols were observed, and all the crews were very aware of the rules and racing signals. There was no hesitation in stopping any race if safety was thought to have been compromised.

From the first season, WORK decided that a qualified paramedic, with a range of equipment, should be available during all races, and should be on the water and ready to attend an accident, even though this is not a requirement of the RYA or UIM rules.

When the accident occurred, the paramedic was on scene in seconds and able to administer the necessary lifesaving first-aid. Had this not been the case, the injuries sustained and the outcome might have been worse.

2.5.2 Course design

The course design used by K-class racing is a smaller version of a standard adult racing course ('M' shaped with overall dimensions of 400-600m x 450m), which comprises 90º turns, and a chicane which is not used on the first lap.

The race begins at the start buoy as shown in **Figure 4**, and proceeds anti-clockwise for an agreed duration, typically 10 minutes. At the end of the agreed time, competitors complete the lap they are on to finish by crossing the start line.

The majority of collisions occur at the first 90º turn, when the boats are still bunched and vying for position. There is a predictable risk at this point, of one boat hooking and being overridden by a boat following.

Two known methods to reduce the danger at the first turn are:

- Stretching the first leg, to allow the boats more time to separate,
- Making the turn less severe, by using two or more buoys.

When choosing the course design for junior powerboat racing, it appears that the desire to make it similar to senior racing outweighed any concerns that there might have been about boat crew safety at the first turn. Had rigorous risk assessment procedures been applied at the outset, the design of the course might have been different and the accident avoided.

2.5.3 Suitability of the Sorcerer boat

The Sorcerer ski boat had been raced for many years by adults, and it had a good safety record. However, it is questionable whether a ski boat, with a low freeboard, which leaves the crew sitting in an exposed position, was the best choice for head-to-head junior powerboat racing. It could be argued that in such racing, the likelihood of collisions might be higher.

The Sorcerer ski boat was thoroughly tested by WORK prior to it being chosen and, in many respects, was found to be suitable for the intended purpose. However, the obvious risks to the children in the event of a collision were not given sufficient priority by WORK for it to seek an alternative design, or modify the Sorcerer design to provide better protection to its occupants. This situation persisted after racing was commenced, despite the fact that some boats were overridden by others during competition and training. One such incident in pre-season training did lead to the fitting of anti-intrusion bars on all the K-200 class racing boats in 2003, but, although this increased the protection of the crew, the bars were not, and could not be (see 2.5.6 below) sufficiently robust to protect them in the case of a right angled or near right angled collision between two boats.

The problem was also highlighted by the boat's original designer in correspondence to the RYA in early 2004.

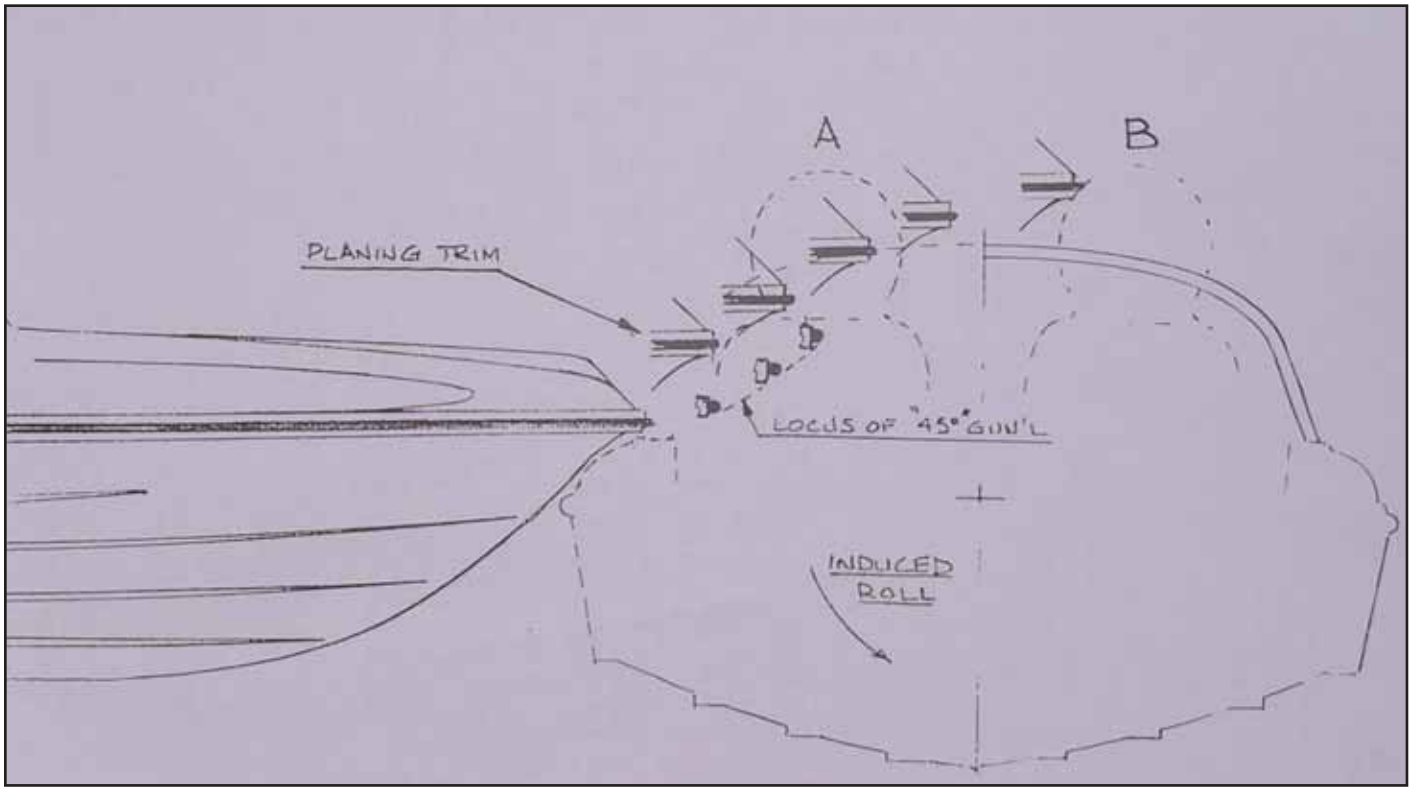
2.5.4 Safety concerns reported to the RYA by the boat designer

In 2003, the relationship between Sorcerer Ltd, who had supplied the club with new boats, and the founder of WORK, broke down acrimoniously. Before that, Sorcerer Ltd had supplied boats, had assisted with training the children, and had helped with the repair of damaged boats, where necessary.

In early 2004, the designer of the boat, a naval architect with 30 years on the RYA officials' list, wrote to the RYA expressing numerous concerns about the safety of K-class racing. In his letter, which included a detailed safety assessment, he highlighted, among many other things, anecdotal evidence, received from Sorcerer Ltd, of a number of accidents which he believed had occurred during the 2003 season. He made particular reference to one accident, which was a collision between two boats which had been almost at right angles to each other. This is the accident that was mis-reported by WORK to the RYA as involving a glancing blow and which is mentioned in 2.4 above. He noted the very real dangers that such a collision poses for the driver and co-driver of the boat which is hit **(see Figure 20)**.

The RYA looked into the matter, and checked the alleged accidents with those reported on the incident report forms. After consultation with the founder of WORK, who was then the chairman of the RYA Offshore Technical and UIM Working Group, the RYA decided that the accidents had either not occurred, or had not occurred in the way the designer believed.

Figure 20



K-class over run sketch by boat designer

As a result, the designer's safety assessment was not brought to the attention of the other members of the Technical or the Safety Working Groups as the designer had requested.

2.5.5 Increase of engine power

The decision to upgrade engines from 20hp to 25hp, and the associated increase in speed, was made for a variety of reasons (see Section 1.8). The RYA discussed the request and decided that the increase would be allowed because 20hp Mercury engines were no longer produced in the UK. The RYA considered the best option was to increase the engine power and therefore the boat speed. The expected increase in speed of just "1 or 2 mph" from a 25% increase in engine power was underestimated. It was in fact 4mph.

Such an important decision regarding an increase in power, and consequent increase in boat speed, should have been the subject of a thorough risk assessment before approval was given for the change to be put in place.

2.5.6 Anti-intrusion bars

WORK took the decision to fit anti-intrusion bars before the start of the 2003 season to prevent crews from being hit by the hull or propeller in overriding incidents. However, the design and strength of the anti-intrusion bars was left to individual owners, and no minimum standard was specified. The bars were fitted during the early part of the season.

The anti-intrusion bar onboard boat K11 was found to be severely distorted by the impact from the hull of K51. It is probable that the bar did provide some protection for the crew of K11, but it did not provide all the protection necessary.

It is probable that anti-intrusion bars could not have been made high enough and strong enough to fully protect the crew from impact in the case of a right angled or near right angled collision. If the dangers associated with this event had been fully understood, it would have been realised that other measures were needed to either reduce the likelihood of collision, or improve the protection offered to the crew.

2.5.7 Risk assessment

The adults in charge of setting up K-class racing had the best interest of the children in mind, and took major decisions only after much thought and consideration. However, they did not apply well recognised and proven risk assessment techniques to ensure that these were, in fact, the best decisions under the circumstances

A driving force seemed to be the absolute need to "mirror" adult racing as far as possible, and this affected critical decisions such as the course design and the need for competitive head-to-head racing.

The following factors should have been carefully considered when the risks for K-class racing were being developed:

- The short first leg and 90º turn at the first mark would lead to bunching of the boats at this point;
- After the first boats had passed the mark, there would be disturbed water;
- The drivers could be young and inexperienced;
- Hooking is more likely to occur at a turn, in disturbed water and with an inexperienced driver;
- A 90° overriding collision is quite likely to occur if a boat hooks at the first turn, when the boats are bunched together;
- The low freeboard of the boat makes the driver, and especially the co-driver, vulnerable in the event of a 90° overriding collision;
- An overriding collision could lead to serious, and possible fatal, injuries.

All of these factors were either known or predictable at the time. When K-class racing was set up, it was not subjected to a rigorous risk assessment process to ensure the children's safety. Such a risk assessment would have recognised the particular problems involved at the first turn, and the need for counter-measures to bring the risk within acceptable limits would have been identified.

Further risk assessments were necessary at important stages in the development of the class, including when the need for anti-intrusion bars was realised, and when the engine size was increased.

2.6 THE ROLE OF THE RYA

The RYA's role as the governing body for K-class racing should have been to monitor, and generally oversee, the safety critical decisions made by WORK, and to challenge these as necessary. In fact, the RYA seemed content to allow WORK to set up and develop the racing without critical oversight. The founder of WORK was well respected in the sport and was the chairman of the RYA's Technical Offshore Safety Working Group. This group was subsequently merged with the Offshore Safety Working Group to form the Safety and Technical Group **(see Figure 10)** during the time that K-class was being developed. As junior offshore powerboat racing was a novel sport, there was nobody else to call on with the necessary experience for advice and criticism. This resulted in the permanent employees and committees of the RYA trusting WORK to organise the class and, apart from being involved in the initial training programme, and at the first few race meetings, they then, seemingly, paid only little attention to how the class was being run and developed.

K-class racing was a new class of an extreme sport involving children. The RYA should have paid very close attention to all safety-critical aspects of the race organisation. The RYA should also have ensured WORK's risk assessments were accurate and effective before giving approval for the new class, and

thereafter they should have closely monitored all developments within the sport. Particular care should have been taken over the causes of any accidents which occurred within the sport, the supervision of the accident reporting process, and the thorough evaluation of any proposals for change to the existing racing rules.

2.7 SAFETY HELMET

It became apparent during the investigation that the subject of head protection in powerboat racing had not been fully addressed. The RYA recommended a motorcycle helmet standard believing that the protection afforded was good. However, they were also aware of known problems arising from the use of motorcycle helmets in the marine environment, such as the "bucket or scoop effect" should the wearer be thrown into the water at speed.

The MK10 GMSH was specifically developed over many years for use by the RNLI as a lightweight safety helmet to replace the various helmets being used by their crews at that time. The helmet was designed to protect against the specific dangers faced by RNLI crews.

There was a widespread belief that the MK10 GMSH was "one size fits all". Indeed, Gecko Head Gear Ltd's website intimated as much.

The MK10 helmet was tested and stamped for head sizes 57 – 62cm.

An approximate guide to head circumferences is as follows:

Children	48cm to 54cm
Adult	52cm to 64cm

From this, it can be seen that a number of common head sizes, including those for children, are outside the MK10 helmet's test range. The safety of the helmet cannot be considered to have been tested in such circumstances.

During a meeting held on 8 October 2005, the RYA Offshore Racing Committee (ORC) decided to recommend the use of helmets tested to BSI standard PAS 028:2002, which included the MK10 GMSH, for all classes of powerboat racing. The recommendation would have been incorporated as an amendment in the 2005 rule book (PB1/05), had it been published.

The implications of such an important decision concerning such a critical and complex matter were not properly considered.

Early in the investigation, the MAIB published Safety Bulletin 03/2005, (see Section 4 and **Annex A**). In this, the RYA was recommended to conduct a risk assessment to establish the suitability of its existing recommended standard of helmet, BS6658B, for use in each class of RYA powerboat; liaise with the British Standards Institute to identify suitable standards if the outcome of the risk assessment determined this to be required, and to work with industry to ensure the availability of such helmets.

2.7.1 Dislodgement of the co-driver's helmet

What caused the helmet of K11's co-driver to come off during the accident may never be established. Despite careful scrutiny of the video recording, the MAIB could not determine when the helmet became dislodged. The helmet was found to be largely undamaged, the chin strap was fastened and the bladder partially inflated. Anecdotal evidence indicates that the co-driver was usually careful to ensure the helmet was donned correctly. However, the co-driver had a head circumference of 54cm and the helmet was only tested for head sizes between 57cm and 62cm. Furthermore, an important part of the helmet's securing arrangement, the sleeve on the chin strap, was found to be missing, and this could have had a bearing on the security of the fastening.

A possible scenario is that the bow of K51 struck the lower edge of the back of the helmet, tipping it forward and off the boy's head.

2.8 OBJECTIVE OVERVIEW FOR K-CLASS RACING

K-class racing was managed and operated by enthusiastic volunteers who generally were involved in some way with the adult sport. The volunteers gave their time freely, and the children who participated benefited considerably from their involvement with the sport.

The RYA's overview of K-class, and other powerboat racing, was managed to a very large extent by volunteers who were either active participants in the sport or who had commercial connections with it.

The day to day practical aspects of K-class racing were run very well and the safety of the children was paramount. However, the development of the class seems to have lacked a detached and objective oversight bearing in mind the potential risk to the children posed by competitive racing. In future, the administration of the sport would benefit from the involvement of a risk management professional who could provide this independent advice.

SECTION 3 - CONCLUSIONS

3.1 SAFETY ISSUES

The following safety issues have been determined from the foregoing analysis. They are not listed in any particular order of priority.

- The collision took place at the first turn, when boat K11 violently hooked, and K51, which was following immediately behind on a slightly tighter course to the marker buoy, collided with her at full speed and a near right angle. [2.2]

- During the course of the collision, the helmet of K11's co-driver became dislodged, and it was later found in the sea a short distance away from the boat. [2.2, 2.7]

- Neither WORK nor the RYA had formally laid down minimum training criteria for new entrants who might wish to become junior powerboat racers. [2.3]

- The collision involved two young drivers who were in their first season and had minimal training in K-class racing. [2.3]

- Scrutiny of the club's records suggests that WORK was not giving sufficient priority to the completion and submission of accident and incident reports. [2.4]

- The accident reports that were received by the RYA received only minimal attention. [2.4]

- K-class races were very well organised, and several volunteer adult race officials were involved, many of whom were stationed around the course in boats during the racing. [2.5]

- When the accident occurred, the paramedic was on scene in seconds and able to administer the necessary lifesaving first-aid. Had this not been the case, the injuries sustained and the outcome might have been worse. [2.5.1]

- When choosing the course design for Junior Powerboat racing, it appears that the desire to make it similar to senior racing outweighed any concerns that there might have been about boat safety at the first turn. [2.5.2]

- Anti-intrusion bars were fitted to all K-200 class boats in 2003 as a result of some accidents and incidents. However, they were not sufficiently robust to protect them in the case of a right angled or near right angled collision between two boats. [2.5.3]

- Warnings given to the RYA by the boat's designer were not heeded. [2.5.4]

- The proposed change from 20hp to 25hp engines should have been the subject of a thorough risk assessment before the rules for K-class racing were changed. [2.5.5]

- When K-class racing was set up, it was not subjected to a rigorous risk assessment process to ensure the children's safety. Such a risk assessment would have recognised the particular problems involved at the first turn, and the need for counter-measures to bring the risk within acceptable limits would have been identified. [2.5.7]

- The RYA should have ensured WORK's risk assessments were accurate and effective before giving approval for the new class, and thereafter they should have closely monitored all developments within the sport. [2.6]

- There has never been any proper assessment of the requirements of a safety helmet for powerboat racing which would lead to the identification, or development, of a suitable standard. [2.7]

- The MK10 GMSH was only tested for sizes 57cm to 62cm. As such, it was not tested for safety for many head sizes, including most children's. [2.7.1]

- What caused the helmet of K11's co-pilot to come off during the accident may never be established. However, the boy's head was smaller and outside the range of head sizes for which the helmet had been tested, and an important part of the helmet's securing arrangement was missing. [2.7.1]

- The development of K-class racing seems to have lacked a detached and objective oversight bearing in mind the potential risk to the children posed by competitive racing. [2.8]

SECTION 4 - ACTION TAKEN

4.1 MAIB SAFETY BULLETIN 3/2005

MAIB issued a safety bulletin during the investigation **(Annex A)** on 22 August 2005, which recommended:

RYA to: *Conduct a risk assessment to establish the suitability of its existing recommended standard of helmet, BS6658B, for use in each class of RYA powerboat; liaise with the British Standards Institute to identify suitable standards if the outcome of the risk assessment determines this to be required, and work with industry to ensure the availability of such helmets;*

and strongly advised:

All users of marine safety helmets to ensure:

- *the helmet is a proper fit, by ensuring the wearer's head is not free to turn inside the helmet, and removal of the helmet, by rolling it forward and down, is not readily possible;* and
- *recommended donning instructions are complied with each and every time the helmet is used.*

4.2 WANDA OFFSHORE RACING KLUBB

Wanda Offshore Racing Klubb produced a report dated 4th July 2005, implementing the following:

Primary action

- Develop course structure to remove acute first turn.
- Enlarge length of start run approach from muster point, to allow greater separation.
- Reduce quantity of craft per race to max 5.

Secondary action

- Review start procedure/sequence.
- Review design and develop further, where possible, safety equipment features.
- Enhance further the approved training programme to address the primary actions above.
- Provide further training from helmet manufacturers on the specific use of equipment.
- Provide 'improver' courses to enable further skill development.

Further action proposed since the above report includes:

Head-to-head racing for 8 to 12 year olds will be stopped. During the 2006 national championships, this younger group will be required to navigate around a slalom type skill course in a time trial, with just one boat on the course at a time. Slow speedboat handling trials will also be introduced, where crews will be required to manoeuvre their boats alongside berths, pick up objects from the water and secure to long and short stays.

A written minimum training syllabus has been instigated to RYA Powerboat Level 2 standard.

WORK has made it clear to parents that the MK10 GMSH is not tested for children's head sizes.

4.3 GECKO SAFETY HELMETS LTD

The company website wording has been altered so that it does not intimate that the helmet is 'one size fits all'.

Helmet fitting and donning instructions have been extensively re-written to enable the user to determine whether the helmet supplied is a proper fit, how to wear it correctly, and determine if it is being worn correctly by use of a *roll test*.

The company now stipulates that the MK10 GMSH is suitable for head sizes 57cm to 62cm circumference, and customers must make their own evaluation if their head size is outside this range.

4.4 ROYAL YACHTING ASSOCIATION (RYA)

RYA has responded to safety bulletin 3/2005 by commissioning consultants to carry out a comprehensive review of the suitability of helmets in the sport of powerboat racing. In the meantime, it has mandated that all helmets must be of minimum BS6658 standard.

SECTION 5 - RECOMMENDATIONS

The Royal Yachting Association is recommended to:

2006/144 Consider the safety issues arising from this accident, and develop a pro-active safety management system which is subject to an independent audit by a professional body, to ensure effective oversight of powerboat racing. Particular attention should be given to developing procedures for the oversight of the K-class racing classes.

Wanda Offshore Racing Klubb is recommended to:

2006/145 In addition to the actions already taken, prior to the start of the 2006 racing season, carry out formal written risk assessments of all aspects of junior offshore powerboat racing, and ensure full and effective control measures are put in place to protect the children's safety.

Marine Accident Investigation Branch
March 2006

Safety recommendations shall in no case create a presumption of blame or liability

ANNEX A

MAIB Safety Bulletin 3/2005

MAIB SAFETY BULLETIN 3/2005

Very serious injury to the 13 year old co-driver

of a powerboat following a collision in a

junior offshore powerboat race

in Portland harbour on 19 June 2005

MAIB SAFETY BULLETIN 3/2005

This document, containing safety lessons, has been produced for marine safety purposes only, on the basis of information available to date.

The Merchant Shipping (Accident Reporting and Investigation) Regulations 2005 provide for the Chief Inspector of Marine Accidents to make recommendations at any time during the course of an investigation if, in his opinion, it is necessary or desirable to do so.

The Marine Accident Investigation Branch (MAIB) is carrying out an investigation into the accidental collision between two boats during a junior offshore powerboat race that resulted in a very serious injury to the 13 year old co-driver of one boat on 19 June 2005. The MAIB will publish a full report on completion of the investigation.

Stephen Meyer
Chief Inspector of Marine Accidents

This bulletin is also available on our website: http://www.maib.gov.uk

Press Enquiries: 020 7944 3232/3387; out of hours: 020 7944 4292
Public Enquiries: 020 7944 3000
INTERNET ADDRESS FOR DFT PRESS NOTICES:
http://www.dft.gov.uk

BACKGROUND

At about 1320 on 19 June 2005 two powerboats collided in a junior offshore powerboat race which resulted in a very serious injury to the 13 year old co-driver of one boat.

The race was part of a national powerboat racing class organised and run by a private racing club affiliated to the Royal Yacht Association, where children aged between 8 and 16 years of age race 12 foot/3.75 metre boats powered by a 25HP engine around a set course at speeds in excess of 25mph.

The injured child was wearing a Mark 10 Gecko Marine Safety Helmet which became dislodged during the collision and was found in the sea a short distance away from the boat.

The Mark 10 marine safety helmet is tested to the PAS028.2002 standard by British Standards Institute and CE marked for use by persons with a head circumference of between 57 and 62cm, which is the average head size for an adult male. However, subsequent investigations by the MAIB have identified a widespread misconception among many users that the helmet is “one size fits all” and offers protection to all, including children. A description of the product on the manufacturer’s website could have been construed to infer the helmet was “one size fits all”. Gecko Head Gear Limited has undertaken to remove this wording from their website.

Further investigation by the MAIB has found that the helmet type was developed with the assistance of and specifically for the dangers confronted by crew members in the Royal National Lifeboat Institution and similar marine emergency service users. It was not designed for those partaking in high speed powerboat racing, and does not have the impact protection recommended by the RYA for headgear used in that activity.

However, the Gecko Mark 10 is the only helmet in the U.K. designed specifically for use in a marine environment. There is some concern that helmets which have not been designed specifically for marine use have other safety drawbacks - most specifically a scoop effect, when the wearer enters the water at speed, which could lead to serious neck injuries. Therefore, at present there does not appear to be a helmet available which is completely suited to this type of activity.

SAFETY RECOMMENDATIONS

1. All users of marine safety helmets are strongly advised to ensure:

    - the helmet is a proper fit, by ensuring the wearer's head is not free to turn inside the helmet and removal of the helmet by rolling it forward and down is not readily possible; and

    - recommended donning instructions are complied with each and every time the helmet is used

2. The ongoing MAIB investigation into this accident has revealed safety concerns and uncertainty over the specified standard for helmets (BS 6658B) recommended by RYA for use in powerboat racing.

As a consequence, the RYA is recommended to:

2005/192 Conduct a risk assessment to establish the suitability of its existing recommended standard of helmet, BS6658B, for use in each class of RYA powerboat; liaise with the British Standards Institute to identify suitable standards if the outcome of the risk assessment determines this to be required and work with industry to ensure the availability of such helmets.